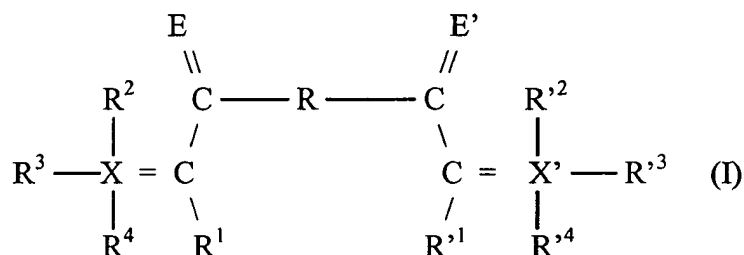


# LISTING OF CLAIMS

Claim 46 (Previously Added): A catalytic system comprising:

(A) at least one ligand represented by formula (I):



where:

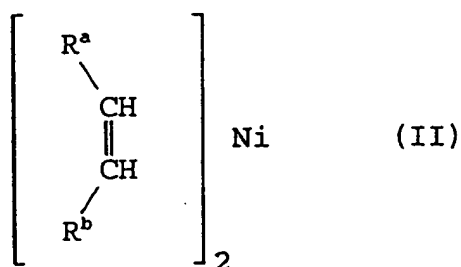
- E and E' each represent independently an oxygen or a sulfur atom;
- X and X' each represent independently a phosphorus, arsenic or antimony atom;
- the radicals R<sup>1</sup> and R'<sup>1</sup>, which are identical or different, are selected from:
  - hydrogen;
  - linear, branched or cyclic alkyl radicals;
  - aryl radicals;
  - arylalkyl radicals;
  - alkylaryl radicals;
  - halogens;
  - the hydroxy radical;
  - alkoxide radicals;
  - -C(=O)OR', wherein R' represents a hydrocarbon radical which has from 1 to 15 carbon atoms;
  - -SO<sub>3</sub>Y, where Y is selected from Li, Na, NH<sub>4</sub><sup>+</sup>, NR''<sub>4</sub><sup>+</sup>, where R'' represents a hydrocarbon radical which has from 1 to 15 carbon atoms;

- the  $R^2, R'^2, R^3, R'^3, R^4$  and  $R'^4$  radicals, which are identical or different, are chosen from linear, branched or cyclic alkyl radicals, and arylalkyl radicals;

- R is a divalent radical; and

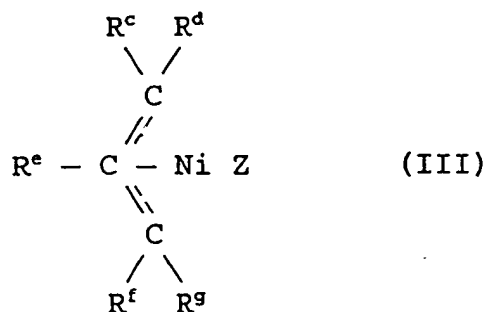
(B) at least one nickel compound selected from:

(B1) nickel complexes with a zero oxidation state, which are represented by the general formula (II):



where  $R^a$  and  $R^b$  each represent independently a hydrogen atom, or a linear, branched or cyclic alkyl radical or aryl, arylalkyl or alkylaryl radical, which have up to 8 carbon atoms, it being also possible for  $R^a$  and  $R^b$  to form together a divalent aliphatic group of 2 to 10 carbon atoms and have up to three olefinic double bonds as the only carbon-carbon unsaturated groups;

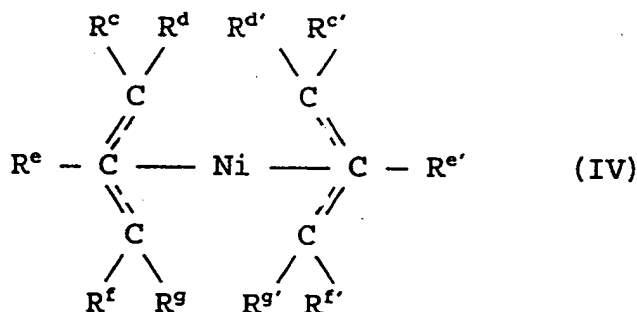
(B2)  $\pi$ -allylnickels, which are represented by the formula (III):



in which:

- the  $R^c$ ,  $R^d$ ,  $R^e$ ,  $R^f$  and  $R^g$  radicals, which are identical or different, are selected from hydrogen, linear, branched or cyclic alkyl radicals and aryl, arylalkyl or alkylaryl radicals, having up to 8 carbon atoms;
- the dotted lines represent the electron delocalization on the three contiguous carbon atoms;
- an  $R^c$  or  $R^d$  radical may also form, with an  $R^e$  or  $R^f$  or  $R^g$  radical, a divalent alkene group having from 2 to 10 carbon atoms and able to have up to three olefinic double bonds; and
- Z represents a halogen, an alkoxy group or an alkanoyloxy group;

(B3) compounds of the bis(allyl)nickel type which are represented by the (IV):



in which:

- the radicals  $R^c$  to  $R^g$ , and  $R^{c'}$  to  $R^{g'}$ , which are identical or different, are selected from hydrogen, linear, branched or cyclic alkyl radicals and aryl, arylalkyl or alkylaryl radicals having up to 8 carbon atoms;
- the dotted lines represent the electron delocalization on the three contiguous carbon atoms;
- a radical  $R^c$  or  $R^d$  also able to form, with a radical  $R^e$  or  $R^f$  or  $R^g$ , a divalent alkene group having from 2 to 10 carbon atoms and able to have up to three olefinic double bonds;

DI  
- a radical R<sup>c'</sup> or R<sup>d'</sup> also able to form, with a radical R<sup>e'</sup> or R<sup>f'</sup> or R<sup>g'</sup>, a divalent alkene group having from 2 to 10 carbon atoms and able to have up to three olefinic double bonds.

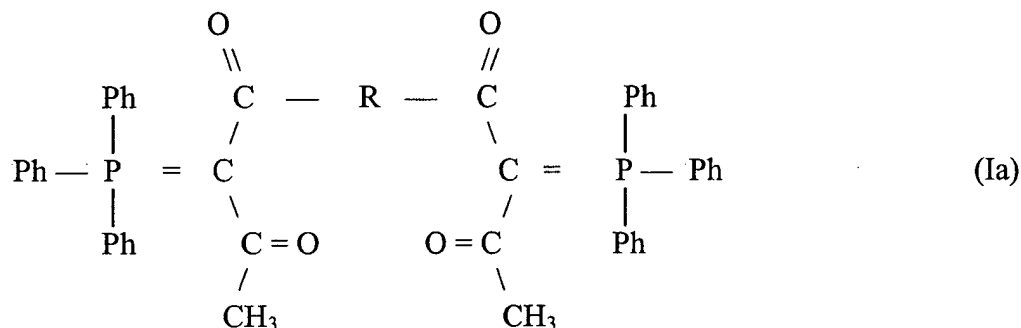
Claim 47 (Previously Added): The catalytic system as claimed in claim 46, wherein, in formula (I), E and E' are separated by intermediate atoms linked together by covalent or coordinate bonds.

Claim 48 (Previously Added): The catalytic system as claimed in claim 46, wherein, in formula (I), the minimum number of atoms between E and E' is from 3 to 40.

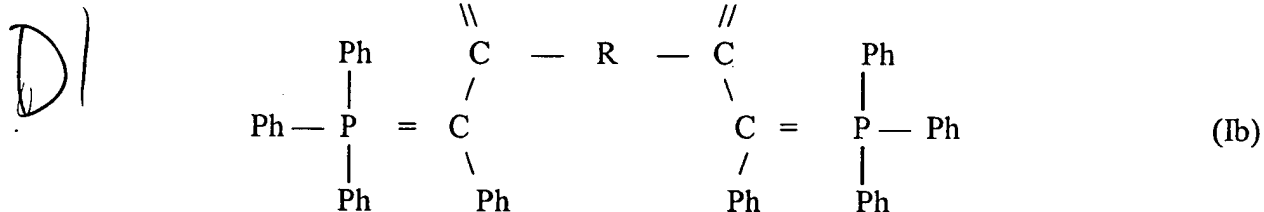
Claim 49 (Previously Added): The catalytic system as claimed in claim 46, wherein, in formula (I), R is selected from:

divalent hydrocarbon radicals comprising from 2 to 38 carbon atoms; and  
the 1,1'-ferrocenylene radical which is substituted or unsubstituted.

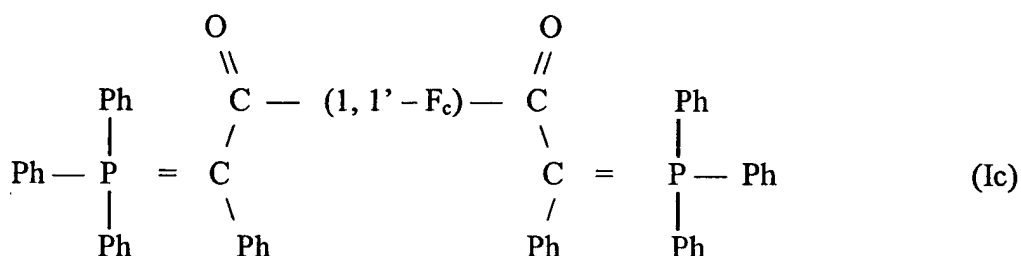
Claim 50 (Previously Added): The catalytic system as claimed in 46, wherein the ligand of formula (I) comprises one of the following structures:



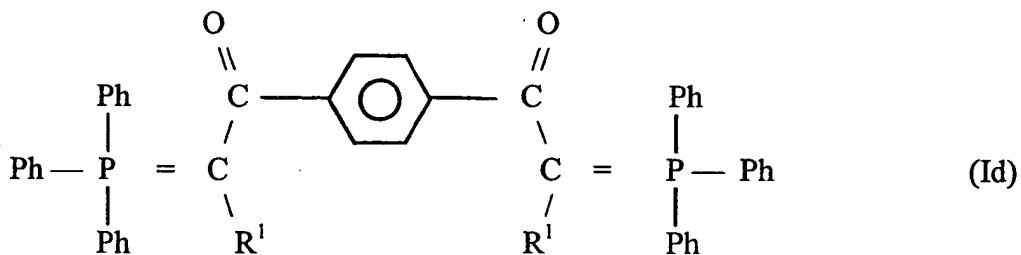
where R represents a 5,6-bicyclo[2.2.1]hept-2-ene radical; -(CH<sub>2</sub>)<sub>4</sub>- or -(CH<sub>2</sub>)<sub>8</sub>- ;



where R represents a 5,6-bicyclo[2.2.1]-hept-2-ene radical; or  $-(\text{CH}_2)_8-$ ;



where 1,1'-Fc represents a-1,1'-ferrocenylene radical; and



where  $\text{R}^1$  represents H or Ph or  $\text{SO}_3\text{Na}$  or  $-\text{C}(=\text{O})-\text{O}-\text{CH}_3$

Claim 51 (Previously Added): The catalytic system as claimed in claim 46, wherein the nickel compound ( $\text{B}_1$ ) is selected from:

- bis(1,5-cyclooctadiene)nickel(0);
- bis(cyclooctatetraene)nickel(0); and

•bis(1,3,7-octatriene)nickel(0).

D1  
Claim 52 (Previously Added): The catalytic system as claimed in claim 46, wherein, in a nickel compound (B2) or (B3), a  $\pi$ -allyl group has from 3 to 12 carbon atoms which do not have other aliphatic unsaturated groups, except where it contains a closed cycle.

Claim 53 (Previously Added): The catalytic system as claimed in claim 46, wherein the nickel compound (B2) is selected from:

- $\pi$ - allylnickel chloride;
- $\pi$  - allylnickel bromide;
- $\pi$  - crotylnickel chloride;
- $\pi$  - methylallylnickel chloride;
- $\pi$  - ethylallylnickel chloride;
- $\pi$  - cyclopentylallylnickel bromide;
- $\pi$  - cyclooctenylnickel chloride;
- $\pi$  - cyclooctadienylnickel chloride;
- $\pi$  - cynamylnickel bromide;
- $\pi$  - phenylallylnickel chloride;
- $\pi$  - cyclohexenylnickel bromide;
- $\pi$  - cyclododecenylnickel chloride;
- $\pi$  - cyclododecatrienylnickel chloride;
- $\pi$  - allylnickel acetate;
- $\pi$  - methylallylnickel propionate;
- $\pi$  - cyclooctenylnickel octoate;
- $\pi$  - cyclooctenylnickel methoxylate; and
- $\pi$  - allylnickel ethoxylate.

Claim 54 (Previously Added): The catalytic system as claimed in claim 46, wherein the nickel compound (B3) is selected from:

- DI
- . bis( $\pi$  - allyl)nickel;
  - . bis( $\pi$  - methallyl)nickel;
  - . bis( $\pi$  - cinnamyl)nickel;
  - . bis( $\pi$  - octadienyl)nickel;
  - . bis( $\pi$  - cyclohexenyl)nickel;
  - .  $\pi$  - allyl-  $\pi$  - methallylnickel; and
  - . bis( $\pi$  - cyclooctatrienyl)nickel.

Claim 55 (Previously Added): The catalytic system as claimed in claim 46, wherein the components (A) and (B) are present in amounts such that the nickel-to-ligand(s) molar ratio is between 1 and 100.

Claim 56 (Previously Added) The catalytic system as claimed in claim 55, wherein the components (A) and (B) are present in amounts such that the nickel-to-ligand(s) molar ratio is between 2 and 50.

Claim 57 (Previously Added): A process for the polymerization of at least one olefin in the presence of a catalytic system as defined in claim 46.

Claim 58 (Previously Added): The process as claimed in claim 57, wherein:

- in a first step, each of the constituents (A) and (B), which are in solution in an inert solvent, are introduced separately or simultaneously into a reactor, together with the reaction mixture; and
- in a second step, the olefin or olefins are introduced, the (co)polymerization taking place at a temperature between 0 and 300°C and at a total absolute pressure of from 1 to 200 bar.

DI  
Claim 59 (Previously Added): The process as claimed in claim 58, wherein the constituents (A) and (B) are introduced in a nickel-to-ligand(s) molar ratio of between 1 and 100.

Claim 60 (Previously Added): The process as claimed in claim 59, wherein the constituents (A) and (B) are introduced in a nickel-to-ligand(s) molar ratio of between 2 and 50.

Claim 61 (Previously Added): The process as claimed in claim 58, wherein the inert solvent of constituents (A) and (B) is selected from saturated aliphatic hydrocarbons, saturated alicyclic hydrocarbons, aromatic hydrocarbons and mixtures thereof.

Claim 62 (Previously Added): The process as claimed in claim 58, wherein the reaction mixture consists of an organic medium.

Claim 63 (Previously Added): The process as claimed in claim 58, wherein the reaction mixture comprises a continuous liquid aqueous phase, which comprises more than 30% water by weight.

Claim 64 (Previously Added): The process as claimed in claim 63, wherein the aqueous phase is the only liquid phase.

Claim 65 (Previously Added): The process as claimed in claim 63, wherein the mixture comprises an organic liquid phase.

Claim 66 (Previously Added): The process as claimed in claim 62, wherein the medium or the organic phase is selected from:

- saturated aliphatic hydrocarbons, saturated alicyclic hydrocarbons, aromatic hydrocarbons and mixtures thereof; and



D1 - to the extent that the polymerization conditions keep them in liquid form,  $\alpha$ -olefins, unconjugated dienes and mixtures thereof.

Claim 67 (Previously Added): The process as claimed in claim 63, wherein the polymerization medium comprises a dispersing agent.

Claim 68 (Previously Added): The process as claimed in claim 67, wherein the dispersing agent is present at up to 10% by weight for the weight of water.

Claim 69 (Previously Added): The process as claimed in claim 68, wherein the dispersing agent is present at 0.01 to 5% by weight for the weight of water.

Claim 70 (Previously Added): The process as claimed in claim 63, wherein the polymerization medium comprises an emulsifying agent.

Claim 71 (Previously Added): The process as claimed in claim 70, wherein the emulsifying agent is present at up to 10% by weight, for the weight of water.

Claim 72 (Previously Amended): The process as claimed in claim 71, wherein the emulsifying agent is present at 0.01 to 5% by weight for the weight of water.

Claim 73 (Previously Added): The process as claimed in claim 70, wherein the emulsifying agent is present in an amount greater than the critical micelle concentration.

Claim 74 (Previously Added): The process as claimed in claim 73, wherein the amount of emulsifying agent is enough so that the polymerization takes place mainly in the micelles.

D1  
Claim 75 (Previously Added): The process as claimed in claim 70, wherein the polymerization medium comprises a liquid organic phase and a cosurfactant.

Claim 76 (Cancelled)

Claim 77 (Currently Amended): The process as claimed in claim ~~76~~ 75 wherein the cosurfactant has a solubility in water of less than  $1 \times 10^{-3}$  mol per liter at 20°C.

Claim 78 (Currently Amended): The process as claimed in claim ~~76~~ 75 wherein the cosurfactant is present at up to 10% by weight for the weight of water.

Claim 79 (Currently Amended): The process as claimed in claim ~~76~~ 75 wherein the emulsifying agent to cosurfactant mass ratio goes from 0.5 to 2.

Claim 80 (Previously Added): The process as claimed in claim 58, wherein the concentration of the constituent (A) in the inert solvent is between 0.1 micromol and 100 millimol per liter of solution.

Claim 81 (Previously Added): The process as claimed in claim 58, wherein the concentration of the constituent (B) in the inert solvent is between 0.1 micromol and 200 millimol per liter of solution.

Claim 82 (Previously Added): The process as claimed in claim 58, wherein it is carried out in an inert atmosphere.

Claim 83 (Previously Amended): The process as claimed in claim 58, wherein, in a preliminary step, the constituents (A) and (B) in solution are brought into contact with each other in their inert solvent, for a duration of 30 seconds to 10 minutes, before their introduction into

the reaction mixture, this precontacting step being carried out in an inert atmosphere, at a temperature of between 0 and 100°C.

D1  
Claim 84 (Previously Added): The process as claimed in claim 83, wherein this precontacting step is carried out at a temperature between 10 and 70°C.

Claim 85 (Previously Added): The process as claimed in claim 58, wherein the constituents (A) and (B), which are in solution in their inert solvent, are introduced separately into the reaction mixture, the latter being held at a temperature of from 0 to 100° C.

Claim 86 (Previously Added): The process as claimed in claim 85, wherein the reaction mixture is held at a temperature from 10 to 70°C.

Claim 87 (Previously Added): The process as claimed in claim 58, wherein the (co)polymerization is carried out at a temperature of between 25 and 200°C.

Claim 88 (Previously Added): The process as claimed in claim 58, wherein the (co)polymerization is carried out at a total absolute pressure of from 1 to 100 bar.

Claim 89 (Previously Added): The process as claimed in claim 58, wherein the olefin or olefins intended to be polymerized are introduced in gas or liquid form, with enough stirring of the polymerization medium.

Claim 90 (Previously Added): The process according to claim 58, characterized in that the olefins are chosen from ethylene,  $\alpha$ -olefins, cyclic olefins and compounds of formula:



D1

in which:

- n is an integer between 2 and 20; and
- G is a radical chosen from:  
-OH;  $\text{CHOHCH}_2\text{OH}$ ; OT;  $-\text{CF}_3$ ;  $-\text{COOT}$ ;  $-\text{COOH}$ ;  
-  $\text{Si}(\text{OH})_3$ ;  $-\text{Si}(\text{OT})_3$ ;

T is a hydrocarbon radical having from 1 to 20 carbon atoms.

Claim 91 (Previously Added): The process as claimed in claim 58, wherein at least one olefin is ethylene.

Claim 92 (Previously Added): The process as claimed in claim 70, wherein the polymerization is carried out in the presence of an emulsifying agent, leading therefore to a latex, if necessary after a filtration step.

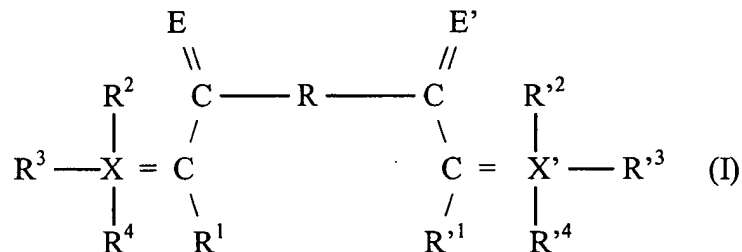
Claim 93 (Previously Added): The process as claimed in claim 92, wherein the latex is a high-density polyethylene or a medium-density polyethylene or a low-density polyethylene.

Claim 94 (Previously Added): The process as claimed in claim 71, wherein the emulsifying agent is present at up to 0.01 to 5% by weight, for the weight of water.

Claim 95 (New): A catalytic system consisting of:

(A) at least one ligand represented by formula (I):

D2



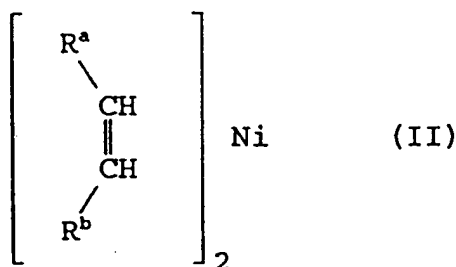
where:

- DL
- E and E' each represent independently an oxygen or a sulfur atom;
  - X and X' each represent independently a phosphorus, arsenic or antimony atom;
  - the radicals  $R^1$  and  $R'^1$ , which are identical or different, are selected from:
    - hydrogen;
    - linear, branched or cyclic alkyl radicals;
    - aryl radicals;
    - arylalkyl radicals;
    - alkylaryl radicals;
    - halogens;
    - the hydroxy radical;
    - alkoxide radicals;
    - $-C-OR'$ , wherein  $R'$  represents a hydrocarbon radical which has from 1 to 15 carbon atoms;  

$$\begin{array}{c} || \\ O \end{array}$$
    - $-SO_3Y$ , where Y is selected from Li, Na,  $NH_4^+$ ,  $NR''_4^+$ , where  $R''$  represents a hydrocarbon radical which has from 1 to 15 carbon atoms;
  - the  $R^2, R'^2, R^3, R'^3, R^4$  and  $R'^4$  radicals, which are identical or different, are chosen from linear, branched or cyclic alkyl radicals, and arylalkyl radicals;
  - R is a divalent radical; and

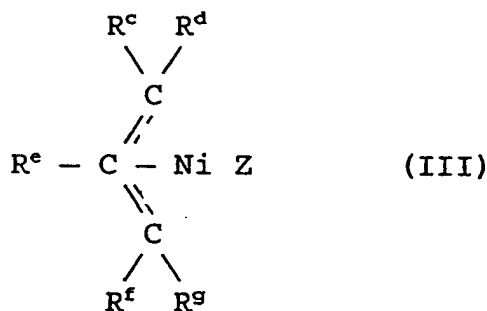
(B) at least one nickel compound selected from:

(B1) nickel complexes with a zero oxidation state, which are represented by the general formula (II):



where  $R^a$  and  $R^b$  each represent independently a hydrogen atom, or a linear, branched or cyclic alkyl radical or aryl, arylalkyl or alkylaryl radical, which have up to 8 carbon atoms, it being also possible for  $R^a$  and  $R^b$  to form together a divalent aliphatic group of 2 to 10 carbon atoms and have up to three olefinic double bonds as the only carbon-carbon unsaturated groups;

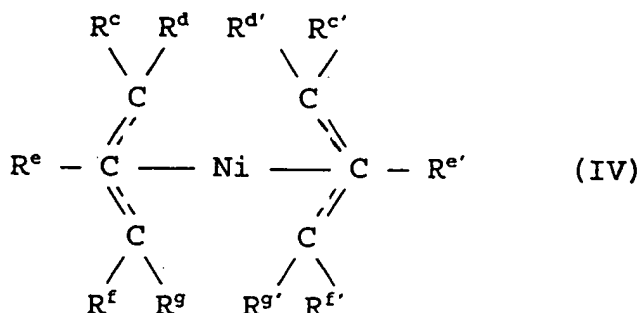
(B2)  $\pi$ -allylnickels, which are represented by the formula (III):



in which:

- the  $R^c$ ,  $R^d$ ,  $R^e$ ,  $R^f$  and  $R^g$  radicals, which are identical or different, are selected from hydrogen, linear, branched or cyclic alkyl radicals and aryl, arylalkyl or alkylaryl radicals, having up to 8 carbon atoms;
- the dotted lines represent the electron delocalization on the three contiguous carbon atoms;
- an  $R^c$  or  $R^d$  radical may also form, with an  $R^e$  or  $R^f$  or  $R^g$  radical, a divalent alkene group having from 2 to 10 carbon atoms and able to have up to three olefinic double bonds; and
- Z represents a halogen, an alkoxy group or an alkanoyloxy group;

(B3) compounds of the bis(allyl)nickel type which are represented by the (IV):

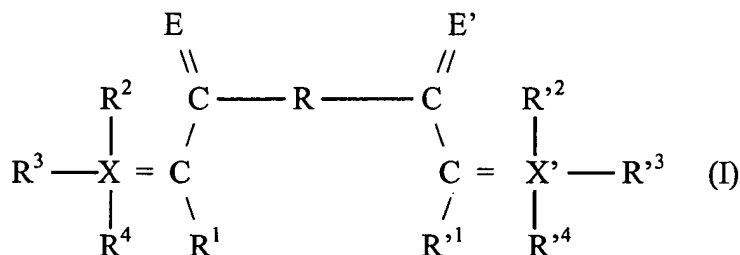


in which:

- the radicals  $R^c$  to  $R^g$ , and  $R^{c'}$  to  $R^{g'}$ , which are identical or different, are selected from hydrogen, linear, branched or cyclic alkyl radicals and aryl, arylalkyl or alkylaryl radicals having up to 8 carbon atoms;
- the dotted lines represent the electron delocalization on the three contiguous carbon atoms;
- a radical  $R^c$  or  $R^d$  also able to form, with a radical  $R^e$  or  $R^f$  or  $R^g$ , a divalent alkene group having from 2 to 10 carbon atoms and able to have up to three olefinic double bonds;
- a radical  $R^{c'}$  or  $R^{d'}$  also able to form, with a radical  $R^{e'}$  or  $R^{f'}$  or  $R^{g'}$ , a divalent alkene group having from 2 to 10 carbon atoms and able to have up to three olefinic double bonds.

DI - Claim 96 (New): A process for the polymerization of at least one olefin in a diluting medium in the presence of a nickel complex formed in situ from a catalytic system consisting of:

(A) at least one ligand represented by formula (I):



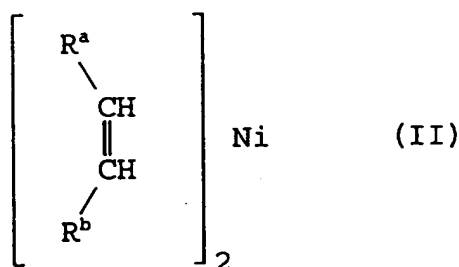
where:

- E and E' each represent independently an oxygen or a sulfur atom;
- X and X' each represent independently a phosphorus, arsenic or antimony atom;
- the radicals  $\text{R}^1$  and  $\text{R}'^1$ , which are identical or different, are selected from:
  - hydrogen;
  - linear, branched or cyclic alkyl radicals;
  - aryl radicals;
  - arylalkyl radicals;
  - alkylaryl radicals;
  - halogens;
  - the hydroxy radical;
  - alkoxide radicals;
  - $-\text{C}(\text{O})-\text{OR}'$ , wherein  $\text{R}'$  represents a hydrocarbon radical which has from 1 to 15 carbon atoms;
  - $-\text{SO}_3\text{Y}$ , where Y is selected from  $\text{Li}$ ,  $\text{Na}$ ,  $\text{NH}_4^+$ ,  $\text{NR}''_4^+$ , where  $\text{R}''$  represents a hydrocarbon radical which has from 1 to 15 carbon atoms;
- the  $\text{R}^2$ ,  $\text{R}'^2$ ,  $\text{R}^3$ ,  $\text{R}'^3$ ,  $\text{R}^4$  and  $\text{R}'^4$  radicals, which are identical or different, are chosen from linear, branched or cyclic alkyl radicals, and arylalkyl radicals;
- R is a divalent radical; and



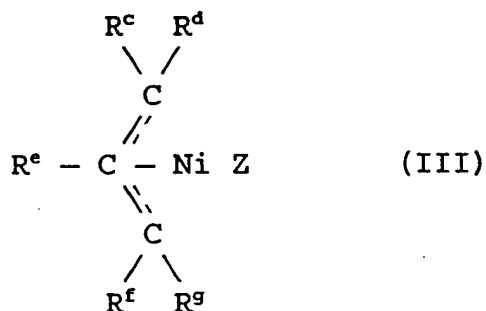
(B) at least one nickel compound selected from:

(B1) nickel complexes with a zero oxidation state, which are represented by the general formula (II):



where  $R^a$  and  $R^b$  each represent independently a hydrogen atom, or a linear, branched or cyclic alkyl radical or aryl, arylalkyl or alkylaryl radical, which have up to 8 carbon atoms, it being also possible for  $R^a$  and  $R^b$  to form together a divalent aliphatic group of 2 to 10 carbon atoms and have up to three olefinic double bonds as the only carbon-carbon unsaturated groups;

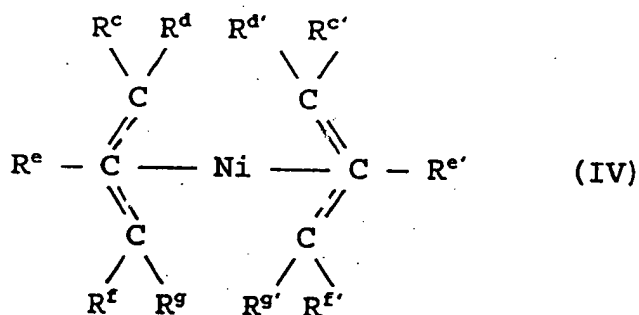
(B2)  $\pi$ -allylnickels, which are represented by the formula (III):



in which:

- the  $R^c$ ,  $R^d$ ,  $R^e$ ,  $R^f$  and  $R^g$  radicals, which are identical or different, are selected from hydrogen, linear, branched or cyclic alkyl radicals and aryl, arylalkyl or alkylaryl radicals, having up to 8 carbon atoms;
- the dotted lines represent the electron delocalization on the three contiguous carbon atoms;
- an  $R^c$  or  $R^d$  radical may also form, with an  $R^e$  or  $R^f$  or  $R^g$  radical, a divalent alkene group having from 2 to 10 carbon atoms and able to have up to three olefinic double bonds; and
- Z represents a halogen, an alkoxy group or an alkanoyloxy group;

(B3) compounds of the bis(allyl)nickel type which are represented by the (IV):



in which:

- the radicals  $R^c$  to  $R^g$ , and  $R^{c'}$  to  $R^{g'}$ , which are identical or different, are selected from hydrogen, linear, branched or cyclic alkyl radicals and aryl, arylalkyl or alkylaryl radicals having up to 8 carbon atoms;
- the dotted lines represent the electron delocalization on the three contiguous carbon atoms;
- a radical  $R^c$  or  $R^d$  also able to form, with a radical  $R^e$  or  $R^f$  or  $R^g$ , a divalent alkene group having from 2 to 10 carbon atoms and able to have up to three olefinic double bonds;

- a radical  $R^c$  or  $R^d$  also able to form, with a radical  $R^e$  or  $R^f$  or  $R^g$ , a divalent alkene group having from 2 to 10 carbon atoms and able to have up to three olefinic double bonds.

① 2